MUSÉE D'HISTOIRE DES SCIENCES
GENÈVE

History of science museum's booklets n° 3

Sun time

Une institution
Ville de Genève

www.museum-geneve.ch

VILLE DE GENÈVE

Conception : Stéphane Fischer, Musée d'histoire des sciences

Text : René Béguin, Anne Fauche, Stéphane Fischer

Translation: Liz Hopkins

Layout and proofreading: Corinne Charvet, Muséum d'histoire naturelle

Illustrations : René Béguin

Photography: Gilles Hernot, Musée d'histoire des sciences; Philippe Wagneur, Muséum d'histoire naturelle

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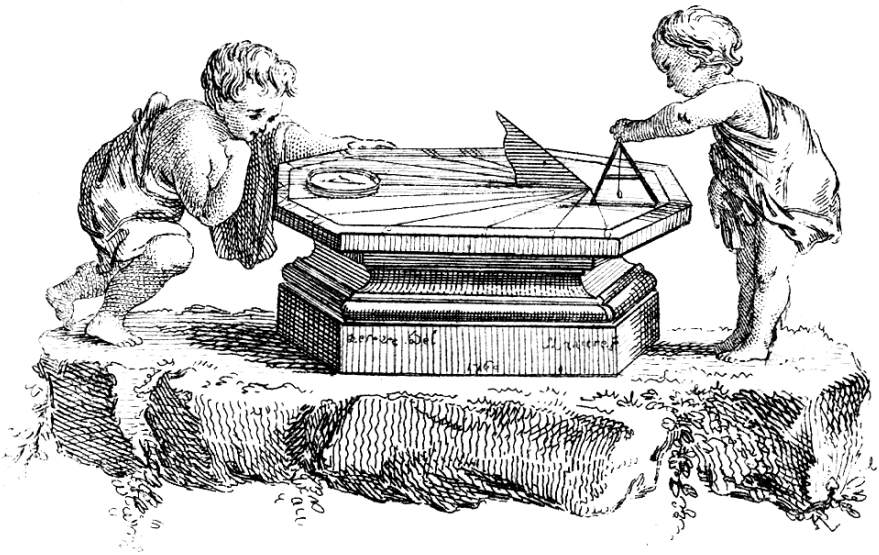
Cover : A gentleman using a quadrant
after Landsberg, 1635, in Gunther, Astrolabes of the World, Londres, 1976
History of science museum Library

Sundials

This booklet briefly describes the different types of sundial exhibited at the Musée d'histoire des Sciences of Geneva and the ways in which they function. Following their invention in early antiquity, sundials were constantly improved and many different types were developed. In order to read the time, some must be oriented in a north-south direction while others face the sun. Whatever the type, the hour is determined by the shadow cast by a fixed object (usually an inclined or horizontal axis) projected onto a surface marked with the hours or hour dial. One weakness of portable sundials was that they were generally designed to give only the local solar time.

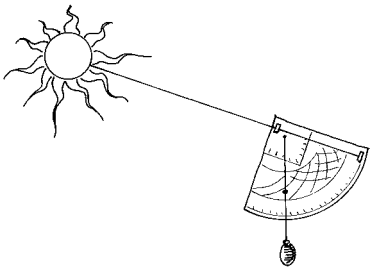


Verification of the horizontal plane and orientation of a horizontal sundial
Bedos de Celles, La gnomonique pratique, Paris, 1760
History of science museum Library

Quadrant

With its origins in antiquity, the quadrant is one of the oldest astronomical instruments. Amongst other features, it shows the time according to the height of the sun. Hour lines are engraved on the surface along with topographical and astronomical information. The hours are indicated by a bead which slides along a plumb line.

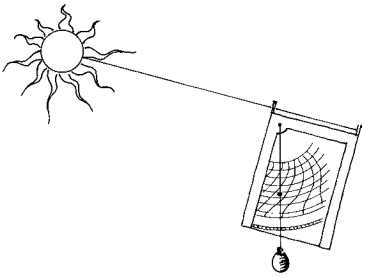
Quadrant
MHS 1711
Brass, Cowland, England, 18th century.



Vertical sundial

This sundial gives the time according to the height of the sun above the horizon and is aligned vertically. After adjusting the date with the bead by sliding it along the weighted line, the two ***pinholes** are aligned with the sun. The time is shown by the position of the bead on one of the wavy hour lines engraved on the plate.

Vertical sundial
MHS 1895
Leather, paper, Baradelle, Guyot, Paris, 18th century.

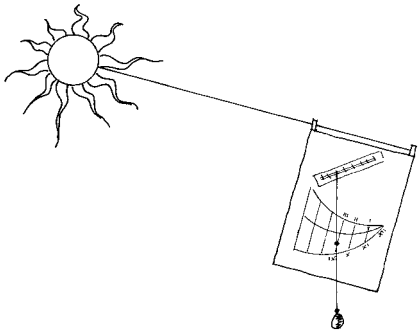


** Terms in bold are explained in the glossary p. 16*

Rectilinear sundial

Also know as the Capuchin (the type which operates on one **latitude** only) or **Regiomontanus** (those which operate across a range of latitudes) this sophisticated version of the vertical sundial shows the hours on parallel time lines.

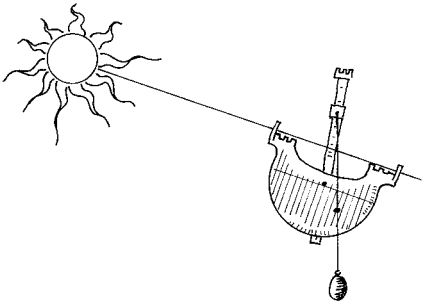
Rectilinear sundial
MHS 2154
Wood, paper, Maintry, France, 18th century.



The “Navicula de Venetiis”

An ancestor of the rectilinear sundial this instrument shaped like a Venetian ship dates from the 14th or 15th century. It is used as follows: the cursor (the point where the plumb line is attached) is placed on the mast at the point corresponding to the **latitude** of the observation location. The mast is adjusted according to the **declination** scale. Finally, the bead is adjusted to the date. All that remains to be done is point the Navicula to the sun lining up the **pinhole sights** at the prow and stern on a ray of sunshine. The bead indicates the time on the straight vertical lines.

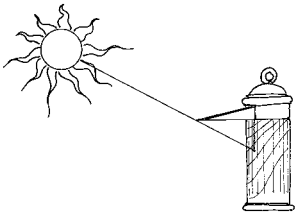
Navicula
MHS 2139
Brass, England (?), 15th century



Shepherd's sundial

The shepherd's sundial determines the time according to the height of the sun in the sky. Very popular until the 19th century, this portable sundial closes like a penknife and offers the hour of the sun without pre-orientation to the **meridian**. To tell the time, the dial is positioned vertically, with the marker placed over the date on the cylinder and pointed at the sun. The point of the shadow of the style falls on the hour-lines drawn on the plate. The shepherd's sundial has two faults : the date of the day of observation must be known in order to place the style in the right place and also whether the reading was taken in the morning or afternoon.

Cylindrical sundial
MHS 1857
Wood, paper, Robert, Paris, 19th century



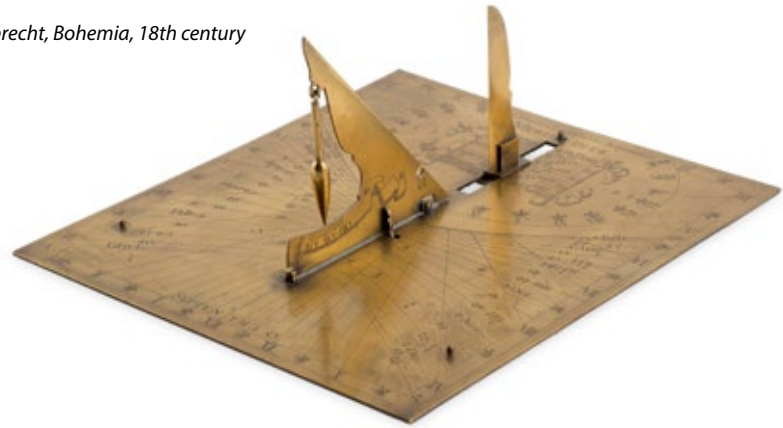
Analemmatic sundial

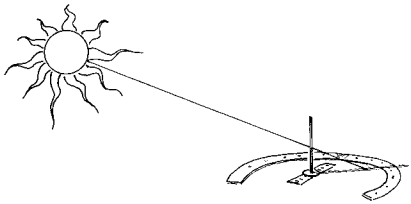
The analemmatic sundial or **azimuth** dial gives the hour by virtue of a vertical, horizontally mobile, **gnomon**. The gnomon is moved during the year on a date scale oriented north-south. It casts its shadow on a horizontal ellipse marked with a time scale.

In geometrical terms, this sundial is none other than the **orthogonal projection** of an astronomical circle (see page 11) on the ground.

An example of a giant analemmatic sundial can be found on the forecourt of the Musée d'histoire des sciences, where the visitor plays himself the role of the gnomon.

Analemmatic and horizontal sundial
MHS 1890
Brass, Engelbrecht, Bohemia, 18th century

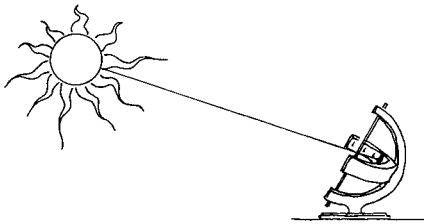




Equatorial sundial

The equatorial sundial must be oriented on a north-south axis before it can be used. Its **style** (the object which casts a shadow), placed parallel to the earth's rotational axis, projects a shadow onto a table of hours (a circular ribbon on the drawing), itself parallel with the **equator**. The table is divided into 24 equal sections corresponding to the 24 hours of a day.

Equatorial sundial
MHS 1870
Brass, Rugendas, Augsburg, 18th century

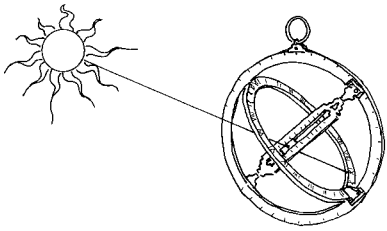


Astronomical ring sundial

This is a specific type of equatorial sundial. It is usually made of two metal circles and a small measuring ruler which can be folded together to form a flat disc for transport. The exterior vertical ring represents the **meridian** and is marked with **latitudes**. It is hung from a small suspension loop which is adjusted according to the latitude of the observation point. The second ring, perpendicular to the first, represents the **equator**. It is marked with 24 equally spaced hour points. Turning on its own axis, a so-called **declination** rule is equipped with a cursor pierced by a hole which is moved according to the date of the observation.

In order to read the hour, the instrument is held by the suspension loop in one hand and turned gently until a ray of sun shines through the hole on the rule and points to an hour-mark on the equator.

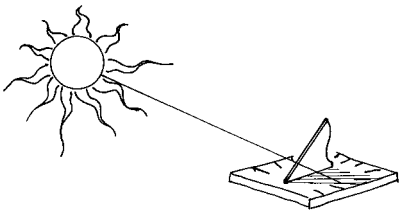
Astronomical ring sundial
MHS 1806
Brass, Netherlands (?), 16th century (?)



Horizontal sundial

The horizontal sundial is oriented north-south before use. The **style** points towards the geographic north, parallel to the axis of the earth's rotation. The shadow of the **style** is projected onto the horizontal table. The angle of the **style** with respect to the table corresponds to the **latitude** of the observation point.

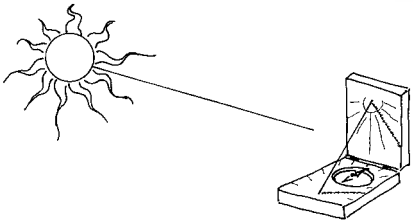
Horizontal sundial
MHS 722
Silver, glass, Butterfield, Paris, 18th century.



Diptych sundial

Very popular in the 17th and 18th centuries, this sundial has both a horizontal and vertical dial joined by a hinge. A taut cord acts as the **style** and joins the two dials when the instrument is open. In order to tell the time, the diptych is oriented with the help of a compass on the horizontal face. The angle of the cord corresponds to the latitude of the observation point. Some diptych sundials are equipped with several different fastenings which allow the cord to be fixed at different angles. They can thus be used at different latitudes.

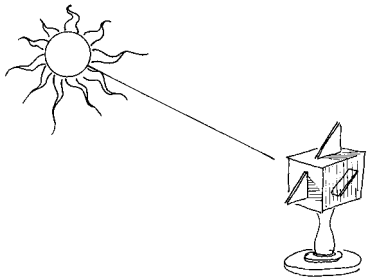
Diptych sundial
MHS 1918
Ivory, brass, Reinmann, Nuremberg, 16th century



Multiple sundial

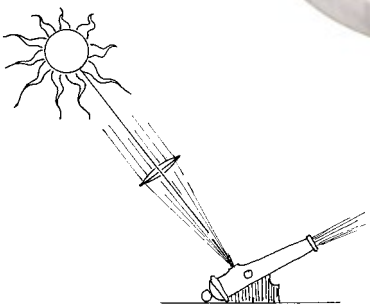
Sundial makers amused themselves by designing the multiple sundial which is more a collector's object than a practical measuring instrument. It is often in the shape of a cube with different types of sundial on each of its faces. When it is correctly oriented, the sundial indicates the time on each of them.

Multiple sundial
MHS 1796
Wodd, brass, paper, Beringer, Nuremberg, 18th century



Mid-day canon

This miniature canon is designed to explode at the real mid-day, that is at the moment when the sun is directly over the local **meridian**. A magnifying glass is carefully positioned to concentrate the sun's rays on the detonator of the canon when the sun is at the height of its trajectory through the sky. In former times, the mid-day canon served to check the time on pocket watches.



Mid-day canon
MHS 1884
Marble, brass, glass, Rousseau, France, 19th century

Glossary

- **Azimuth:** The angle formed by the position of a star on the horizon in relation to the south.
- **Declination:** The angle formed by the sun in relation to the equator. The declination of the sun changes each day from -23°27′ (winter solstice) to +23°27 (summer solstice) passing through 0° (the equinoxes).
- **Equator:** An imaginary line around the earth on which all points are equidistant from the poles. The equator divides the northern from the southern hemisphere.
- **Gnomon:** A vertical pole which casts its shadow on the ground. The gnomon has given its name to the profession of sundial construction, **gnomonics**.
- **Latitude:** The angle formed between an imaginary vertical line joining a point on earth to the centre of the terrestrial globe and the equator. It ranges between 0° to 90° N in the northern hemisphere and between 0° to 90° S in the southern hemisphere. With longitude, latitude is one of the two geographical coordinates which determines the position of places on earth.
- **Meridian:** The imaginary line on a vertical plane which divides the earth from the north to the south pole. In general, the meridian of an observation point is given by the geographical north-south axis.
- **Pinhole:** A small plate pierced with a sight-hole attached to a measuring instrument. Vertical sundials are equipped with them.
- **Orthogonal projection:** A method of representing a three-dimensional object on a flat plane by horizontal perpendicular lines drawn from different points of the object. This type of projection is widely used in technical drawing.
- **Regiomontanus:** A German astronomer, astrologist and mathematician (1436-1476), inventor of various astronomical instruments including the vertical sundial which bears his name.
- **Style:** The part of a sundial which casts its shadow onto an hour chart.

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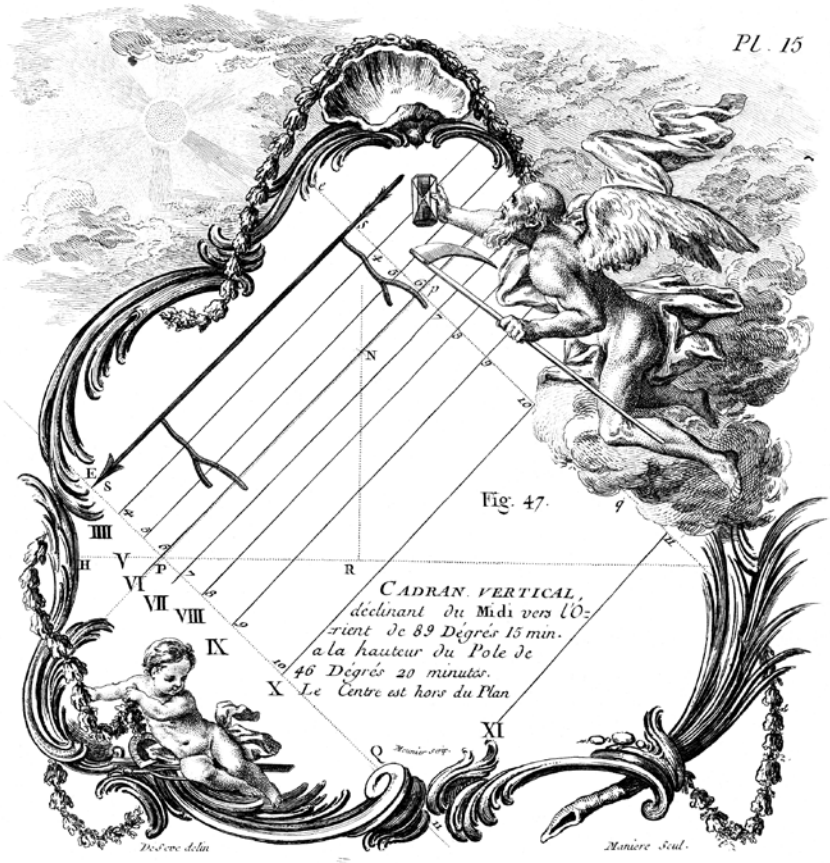
Mid-day canon
Traité de physique, Ganot, Paris, 1860
History of science museum Library



Vertical sundial
La gnomonique pratique, Bedos de Celles, Paris 1760
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History of science museum booklets

The museum collections described in short thematic booklets

1. The skies of Mont Blanc: In the traces of Horace-Bénédict de Saussure (1740-1799), pioneer of Alpine meteorology.
2. Once upon a time, there was electricity: A history of electricity through the instruments at the History of science museum.
3. Sun time: Description and use of the main types of sundial exhibited at the History of science museum.
4. Seeing the infinitely small: Instruments at the History of science museum trace the history of microscopy.
5. Models of the universe: A brief history of celestial measurement through some of the astronomical instruments in the History of science museum.
6. Observing the sky: A brief introduction to astronomy and presentation of instruments from the first Geneva Observatory.
7. The Pictet Cabinet: The art of teaching science through experiment.
8. Jean-Daniel Colladon, Geneva scientist and industrialist.
9. From foot to metre, from marc to kilo: The history of weights and measures illustrated by emblematic objects in the History of Science Museum collection.
10. The beginnings of modern meteorology.
11. Tubes (and light bulbs) at the History of science museum.
12. The Villa Bartholoni.

Downloads available at: http://institutions.ville-geneve.ch/fr/mhn/votre-visite/site-du-musee-dhistoire-des-sciences/parcours-permanent/

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Villa Bartholoni
Parc de la Perle du Lac
Rue de Lausanne 128
1202 Genève
Tél : + 41 22 418 50 60
Open every day from 10am to 5pm except Tuesday
www.museum-geneve.ch
info@museum-geneve.ch

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